

Patent Claims

1. Method for determining the oxygen saturation of blood in the presence of optical disturbance variables, particularly due to a biological tissue surrounding the blood vessel and/or the blood and or the blood vessel itself, in which spectral measurements (M_i) are generated by transmission measurement and reflection measurement in a measurement spectrum at wavelengths that are isosbestic for hemoglobin (Hb) and oxyhemoglobin (HbO_2) and at least one other measurement value (M_a) is generated at a wavelength at which the reference values of hemoglobin and oxyhemoglobin differ, and these measurements are compared with known reference values of the reference spectra of hemoglobin and oxyhemoglobin, characterized in that

- a) at least two said spectral measurement values (M_{i1}, M_{i2}) at wavelengths ($\lambda_{i1}, \lambda_{i2}$) that are isosbestic for hemoglobin and oxyhemoglobin and at least the other measurement value (M_a) at a wavelength (λ_a) at which the reference values of hemoglobin and oxyhemoglobin differ as far as possible in the reference spectra are detected in the measurement spectrum, wherein an auxiliary function (F_H) is generated at least from two of the measurement values (M_{i1}, M_{i2}) for isosbestic wavelengths ($\lambda_{i1}, \lambda_{i2}$),
- b) a reference function (F_R) is generated in the reference spectra from the reference values (R_{i1}, R_{i2}) corresponding to the at least two measurement values (M_{i1}, M_{i2}) determined in the measurement spectrum for the same isosbestic wavelengths ($\lambda_{i1}, \lambda_{i2}$) of hemoglobin and oxyhemoglobin, which reference function (F_R) is of the same type,
- c) a correction function (F_K) is generated from the auxiliary function (F_H) of the measurement spectrum in which said at least two measurement values (M_{i1}, M_{i2}) lie for isosbestic wavelengths ($\lambda_{i1}, \lambda_{i2}$) and from the reference function (F_R) of the reference spectra in which the at least two reference values (R_{i1}, R_{i2}) corresponding to the at least two measurement values (M_{i1}, M_{i2}) lie, and a corrected auxiliary function (F_{HK}) identical to the reference function (F_R) in the reference spectra is generated in a corrected measurement spectrum by means of this correction function (F_K), and
- d) the oxygen saturation of the blood is determined from the other measurement value (M_a) converted to the corrected auxiliary function (F_{HK}) of the corrected measurement

spectrum in relation to the reference values for hemoglobin and oxyhemoglobin at this wavelength (λ_a).

2. Method according to claim 1, characterized in that

- a) three said spectral measurement values (M_{i1} , M_{i2} , M_{i3}) at wavelengths (λ_{i1} , λ_{i2} , λ_{i3}) that are isosbestic for hemoglobin and oxyhemoglobin and another measurement value (M_a) at a wavelength (λ_a) at which the reference values of hemoglobin and oxyhemoglobin differ as far as possible in the reference spectra are determined logarithmically, wherein a linear auxiliary function (F_H) is generated from two logarithmic measurement values (M_{i1} , M_{i2}) for isosbestic wavelengths (λ_{i1} , λ_{i2}),
- b) a linear reference function (F_R) is generated in the reference spectra from the reference values (R_{i1} , R_{i2}) corresponding to the measurement values (M_{i1} , M_{i2}) determined in the measurement spectrum for the same isosbestic wavelengths (λ_{i1} , λ_{i2}) of hemoglobin and oxyhemoglobin,
- c) a linear correction function (F_K) is generated from the auxiliary function (F_H) of the measurement spectrum and from the reference function (F_R) of the reference spectra, and a likewise linear corrected auxiliary function (F_{Hk}) identical to the linear reference function (F_R) in the reference spectra is generated in the corrected measurement spectrum by means of this linear correction function (F_K),
- d) a constant multiplier is applied to the rest of the corrected spectral measurement values, i.e., the third spectral measurement value (M_{i3}') at a wavelength (λ_{i3}) that is isosbestic for hemoglobin and oxyhemoglobin and the other measurement value at a wavelength (λ_a) at which the reference values of hemoglobin and oxyhemoglobin differ as far as possible in the reference spectra, this constant multiplier being determined in such a way that the third spectral measurement value (M_{i3}') of the corrected measurement spectrum that is corrected in this way conforms to the corresponding reference value of the reference spectra.
- e) the oxygen saturation of the blood is read off at the other measurement value (M_a'') that is converted to the corrected auxiliary function (F_{Hk}) of the corrected measurement spectrum on a scale from 0 to 1 contained by the reference values for hemoglobin and oxyhemoglobin at this wavelength (λ_a).

3. Method according to claim 1, characterized in that, for purposes of a two-dimensional representation of the oxygen saturation of the blood, four monochromatic individual images of the spectral measurement values (M_i , M_a) are generated, and in that the oxygen saturation is determined according to steps a) to d) for each image point.